

**WHAT IS CLAIMED IS:**

1. A method for multicast transmission of a message, comprising:
  - 2 processing each of a plurality of data sets to generate a processed data set and a parity block for each data set;
  - 4 processing the parity blocks to generate at least one packet; and transmitting the processed data sets and the at least one packet.
2. The method of claim 1 wherein the processing each of the plurality of
  - 2 data sets comprises:
    - 4 encoding each of the plurality of data sets with a first code to provide a coded data set; and
    - 6 encoding each of the coded data sets with a systematic code to provide the parity block.
3. The method of claim 1 wherein the processing each of the plurality of
  - 2 data sets comprises:
    - 4 encoding each of the plurality of data sets with a first code to provide coded data sets; and
    - 6 puncturing each of the coded data sets to provide the parity block.
4. The method of claim 1 wherein the processing each of the plurality of
  - 2 data sets comprises:
    - 4 encoding each of the plurality of data sets with a first code; and
    - 6 encoding each of the plurality of data sets with a second code.
5. The method of claim 4 wherein the encoding each of the plurality of data
  - 2 sets with a first code and the encoding each of the plurality of data sets with a second code comprises:
    - 4 encoding each of the plurality of data sets with a first code; and
    - 6 encoding each of the plurality of data sets with a second code;
  - 6 wherein at least one code is a systematic code.
6. The method of claim 1 wherein the processing the parity blocks
  - 2 comprises:

encoding the parity blocks with a third code having a pre-determined  
4 code distance to generate at least one second parity block; and

encoding the at least one second parity block with a fourth code to  
6 generate the at least one packet.

7. The method of claim 6 wherein the encoding the parity blocks with a third  
2 code having a pre-determined code distance to generate at least one second  
parity block comprises:

4 encoding the parity blocks with a systematic code.

8. The method of claim 7 wherein the encoding the parity blocks with a  
2 systematic code comprises:

encoding the parity blocks with a Reed-Solomon code.

9. A method for decoding a message, comprising:

2 receiving a plurality of packets comprising the message, and at least one  
other packet;

4 decoding each packet of the plurality of packets comprising the  
message; and

6 decoding each incorrectly decoded packet in accordance with the at  
least one other packet when a number of the incorrectly decoded packets is  
8 less than or equal to a pre-determined code distance.

10. The method of claim 9 wherein the receiving at least one other packet  
2 comprises:

receiving the at least one other packet comprising a first set of parity bits  
4 encoded by a code, the code having a pre-determined code distance.

11. The method of claim 9 wherein the decoding each incorrectly decoded  
2 packet, comprises:

calculating for each correctly decoded packet a parity block;  
4 decoding the at least one other packet to generate a first set of parity  
bits;

6           calculating for each incorrectly decoded packet an associated parity  
 block from the parity blocks of the correctly decoded packets and the first set of  
 8   parity bits; and  
           decoding each of the incorrectly decoded packets from the associated  
 10 parity blocks.

12.   A method for multicast transmission of a message, comprising:

2           processing each of a plurality of data sets to generate a processed data  
 set and a parity block for each data set;  
 4           transmitting the processed data sets as packets;  
           receiving signals containing information about incorrectly decoded  
 6 packets, and when the signals are received:  
           processing the parity blocks to generate at least one packet; and  
 8           transmitting the at least one packet.

13.   The method of claim 12 wherein the processing each of the plurality of  
 2 data sets comprises:

          encoding each of the plurality of data sets with a first code to provide a  
 4 coded data sets; and  
           encoding each of the coded data sets with a systematic code to provide  
 6 the parity block.

14.   The method of claim 12 wherein the processing each of the plurality of  
 2 data sets comprises:

          encoding each of the plurality of data sets with a first code to provide  
 4 coded data sets; and  
           puncturing each of the coded data sets to provide the parity block.

15.   The method of claim 12 wherein the processing each of the plurality of  
 2 data sets comprises:

          encoding each of the plurality of data sets with a first code; and  
 4           encoding each of the plurality of data sets with a second code.

16. The method of claim 15 wherein the encoding each of the plurality of data sets with a first code and the encoding each of the plurality of data sets with a second code comprise:

- encoding each of the plurality of data sets with a first code; and
  - encoding each of the plurality of data sets with a second code;
- wherein at least one code is a systematic code.

17. The method of claim 12 wherein the processing the parity blocks to generate at least one packet comprises:

- selecting a set of bits from the parity blocks in accordance with the received signals; and
- encoding the selected set to generate the at least one packet.

18. The method of claim 17 wherein the selecting a set of bits comprises:

- determining a first number of the incorrectly decoded packets from each of the received signals;

- determining a largest of the determined first numbers; and
- selecting a second number of parity bits for the set from the parity blocks, the second number being equal to a product of the largest determined number and a number of bit positions in the parity block.

19. The method of claim 17 wherein the encoding the selected set comprises:

- encoding the selected set with a third code having a pre-determined code distance to generate at least one second parity block; and
- encoding the at least one second parity block with a fourth code to generate the at least one packet.

20. The method of claim 19 wherein the encoding the selected set with a third code having a pre-determined code distance to generate at least one second parity block comprises:

- encoding the selected set with a systematic code.

21. The method of claim 20 wherein the encoding the selected set with a systematic code comprises:

encoding the selected set with a Reed-Solomon code.

22. The method of claim 17 wherein the selecting a set of bits comprises:

- 2 determining, from each of the received signals, a set of numbers,  
wherein a size of each of the sets of numbers is equal to a size of a set of
- 4 identifiers, wherein each identifier identifies one bit position in each of the parity  
blocks, and wherein each identifier identifies one number in each of the sets of
- 6 numbers;
- 8 determining, for each identifier, a largest number of the numbers  
identified by the identifier;
- 10 providing, for each identifier, a first set of bits comprising bits identified  
by the identifier in each of the parity blocks;
- 12 encoding each of the first sets of bits with a third code having a pre-  
determined code distance to provide a second set of bits; and
- 14 selecting, from parity bits of each of the second sets of bits a second  
number of bits, wherein the second number of bits is equals to the largest  
determined number identified by the identifier.

23. The method of claim 22 wherein the encoding each of the first sets of  
2 bits with a third code having a pre-determined code distance to provide a  
second set of bits comprises:

- 4 encoding each of the first set with a systematic code.

24. The method of claim 23 wherein the encoding each of the first sets of  
2 bits with a systematic code comprises:

encoding each of the first sets of bits with a Reed-Solomon code.

25. The method of claim 17 wherein the encoding the selected set  
2 comprises:

- 4 encoding the selected set with a fourth code to generate the at least one  
packet.

26. A method for decoding a message, comprising:

- 2 receiving a plurality of packets comprising the message;

decoding each packet of the received plurality of packets comprising the  
 4 message;  
     transmitting a signal containing at least one number;  
 6 receiving at least one packet in response to the signal; and  
     decoding the incorrectly decoded packets in accordance with the  
 8 received at least one packet.

27. The method of claim 26 wherein the transmitting a signal containing at  
 2 least one number comprises:  
     transmitting a signal containing a number of incorrectly decoded packets.

28. The method of claim 26 wherein the transmitting a signal containing at  
 2 least one number comprises:  
     transmitting a signal containing a set of numbers.

29. The method of claim 26 wherein the transmitting a signal containing at  
 2 least one number comprises:  
     transmitting a signal containing at least one number when a number of  
 4 incorrectly decoded packet is less than or equal to a code distance.

30. The method of claim 26 wherein the receiving at least one other packet  
 2 comprises:  
     receiving the at least one other packet comprising a first set of parity bits  
 4 encoded by a code, the code having a pre-determined code distance.

31. The method of claim 26 wherein the decoding each incorrectly decoded  
 2 packet, comprises:  
     calculating for each correctly decoded packet a parity block;  
 4 decoding the at least one other packet to generate a first set of parity  
     bits;  
 6 calculating for each incorrectly decoded packet an associated parity  
     block from the parity blocks of the correctly decoded packets and the first set of  
 8 parity bits; and  
     decoding each of the incorrectly decoded packets from the associated  
 10 parity blocks.

32. The method of claim 26 wherein the decoding each incorrectly decoded  
2 packet, comprises:

decoding the at least one other packet to generate a first set of parity  
4 bits;

decoding a subset of incorrectly decoded packet in accordance with the  
6 first set of parity bits;

calculating for each packet from the decoded subset an associated parity  
8 block; and

repeating the decoding a subset of incorrectly decoded packet in  
10 accordance with the first set of parity bits and the calculating for each packet  
from the decoded subset an associated parity block until all incorrectly decoded  
12 packets are decoded.

33. An apparatus for multicast transmission of a message, comprising:

2 a processor;

a storage medium coupled to the processor and containing a set of  
4 instructions executable by the processor to:

process each of a plurality of data sets to generate a processed  
6 data set and a parity block for each data set;

process the parity blocks to generate at least one packet; and

8 a transmitter coupled to the processor and configured to transmit the  
processed data sets and the at least one packet.

34. The apparatus of claim 33 wherein the processor processes each of a  
2 plurality of data sets to generate a processed data set and a parity block for  
each data set by executing a set of instructions to:

4 encode each of the plurality of data sets with a first code to provide a  
coded data set; and

6 encode each of the coded data sets with a systematic code to provide  
the parity block.

35. The apparatus of claim 33 wherein the processor processes each of a  
2 plurality of data sets to generate a processed data set and a parity block for  
each data set by executing a set of instructions to:

- 4 encode each of the plurality of data sets with a first code to provide  
coded data sets; and
- 6 puncture each of the coded data sets to provide the parity block.

36. The apparatus of claim 33 wherein the processor processes each of a  
2 plurality of data sets to generate a processed data set and a parity block for  
each data set by executing a set of instructions to:

- 4 encode each of the plurality of data sets with a first code; and  
encode each of the plurality of data sets with a second code.

37. The apparatus of claim 36 wherein the processor encode each of the  
2 plurality of data sets with a first code and encode each of the plurality of data  
sets with a second code by executing a set of instructions to:

- 4 encode each of the plurality of data sets with a first code; and  
encode each of the plurality of data sets with a second code;
- 6 wherein at least one code is a systematic code.

38. The apparatus of claim 33 wherein the processor processes the parity  
2 blocks by executing a set of instructions to:

- encode the parity blocks with a third code having a pre-determined code  
4 distance to generate at least one second parity block; and  
encode the at least one second parity block with a fourth code to  
6 generate the at least one packet.

39. The apparatus of claim 38 wherein the processor encodes the parity  
2 blocks with a third code having a pre-determined code distance to generate at  
least one second parity block by executing a set of instructions to:

- 4 encode the parity blocks with a systematic code.

40. The apparatus of claim 39 wherein the processor encodes the parity  
2 blocks with a systematic code by executing a set of instructions to:

- encode the parity blocks with a Reed-Solomon code.

41. An apparatus for decoding a message, comprising:



2 a receiver configured to receive a plurality of packets comprising the  
message and at least one other packet;

4 a processor; and

a storage medium coupled to the processor and containing a set of  
6 instructions executable by the processor to:

decode each packet of the plurality of packets comprising the  
8 message; and

decode each incorrectly decoded packet in accordance with the at  
10 least one other packet when a number of the incorrectly decoded  
packets is less than or equal to a pre-determined code distance.

42. The apparatus of claim 41 wherein the at least one other packet  
2 comprises:

a first set of parity bits encoded by a code, the code having a pre-  
4 determined code distance.

43. The apparatus of claim 41 wherein the processor decodes each  
2 incorrectly decoded packet by executing a set of instructions to:

calculate for each correctly decoded packet a parity block;

4 decode the at least one other packet to generate a first set of parity bits;

calculate for each incorrectly decoded packet an associated parity block  
6 from parity blocks of the correctly decoded packets and the first set of parity  
bits; and

8 decode each of the incorrectly decoded packets from the associated  
parity blocks.

44. A apparatus for multicast transmission of a message, comprising:

2 a processor;

a storage medium coupled to the processor and containing a set of  
4 instructions executable by the processor to:

process each of a plurality of data sets to generate a processed  
6 data set and a parity block for each data set; and

process the parity blocks to generate at least one packet;

8 a transmitter, communicatively coupled to the processor, configured to:

transmit the processed data sets as packets; and

10                   transmit the at least one packet; and  
                   a receiver, communicatively coupled to the processor, configured to:  
 12                   receive signals containing information about incorrectly decoded  
                   packets; and  
 14                   provide the information to the processor.

45.    The apparatus of claim 44 wherein the processor processes each of a  
 2    plurality of data sets to generate a processed data set and a parity block for  
   each data set by executing a set of instructions to:

4            encode each of the plurality of data sets with a first code to provide a  
           coded data set; and

6            encode each of the coded data sets with a systematic code to provide  
           the parity block.

46.    The apparatus of claim 44 wherein the processor processes each of a  
 2    plurality of data sets to generate a processed data set and a parity block for  
   each data set by executing a set of instructions to:

4            encode each of the plurality of data sets with a first code to provide  
           coded data sets; and

6            puncture each of the coded data sets to provide the parity block.

47.    The apparatus of claim 44 wherein the processor processes each of a  
 2    plurality of data sets to generate a processed data set and a parity block for  
   each data set by executing a set of instructions to:

4            encode each of the plurality of data sets with a first code; and  
           encode each of the plurality of data sets with a second code.

48.    The apparatus of claim 47 wherein the processor encodes each of the  
 2    plurality of data sets with a first code and encode each of the plurality of data  
   sets with a second code by executing a set of instructions to:

4            encode each of the plurality of data sets with a first code; and  
           encode each of the plurality of data sets with a second code;

6    wherein at least one code is a systematic code.

49. The apparatus of claim 44 wherein the processor processes the parity  
 2 blocks to generate at least one packet by executing a set of instructions to:  
     select a set of bits from the parity blocks in accordance with the  
 4 information provided by the receiver; and  
     encode the selected set to generate the at least one packet.

50. The apparatus of claim 49 wherein the processor selects a set of bits by  
 2 executing a set of instructions to:  
     determine a first number of the incorrectly decoded packets from each of  
 4 the received signals;  
     determine a largest of the determined first numbers; and  
 6 select a second number of parity bits for the set, the second number  
     being equal to a product of the largest determined number and a number of bit  
 8 positions in the parity block.

51. The apparatus of claim 49 wherein the processor encodes the selected  
 2 set by executing a set of instructions to:  
     encode the selected set with a third code having a pre-determined code  
 4 distance to generate at least one second parity block; and  
     encode the at least one second parity block with a fourth code to  
 6 generate the at least one packet.

52. The apparatus of claim 51 wherein the processor encodes the selected  
 2 set with a third code having a pre-determined code distance to generate at least  
     one second parity block by executing a set of instructions to:  
 4 encode the selected set with a systematic code.

53. The apparatus of claim 52 wherein the processor encodes the selected  
 2 set with a systematic code by executing a set of instructions to:  
     encoding the selected set with a Reed-Solomon code.

54. The apparatus of claim 49 wherein the processor selects a set of bits by  
 2 executing a set of instructions to:  
     determine, from each of the received signals, a set of numbers, wherein  
 4 a size of each of the sets of numbers is equal to a size of a set of identifiers,

wherein each identifier identifies one bit position in each of the parity blocks,  
 6 and wherein each identifier identifies one number in each of the sets of  
 numbers;

8 determine, for each identifier, a largest number of the numbers identified  
 by the identifier;

10 provide, for each identifier, a first set of bits comprising bits identified by  
 the identifier in each of the parity blocks;

12 encode each of the first sets of bits with a third code having a pre-  
 determined code distance to provide a second set of bits; and

14 select, from parity bits of each of the second sets of bits a second  
 number of bits, wherein the second number of bits is equals to the largest  
 16 determined number identified by the identifier.

55. The apparatus of claim 54 wherein the processor encodes each of the  
 2 first sets of bits with a third code having a pre-determined code distance to  
 provide a second set of bits by executing a set of instructions to:

4 encode each of the first sets of bits with a systematic code.

56. The apparatus of claim 56 wherein the processor encodes each of the  
 2 first sets of bits with a systematic code by executing a set of instructions to:

encode each of the first sets of bits with a Reed-Solomon code.

57. The apparatus of claim 49 wherein the processor encodes the selected  
 2 set by executing a set of instructions to:

4 encode the selected set with a fourth code to generate the at least one  
 packet.

58. A apparatus for decoding a message, comprising:

2 a receiver configured to:

receive a plurality of packets comprising the message; and

4 receive at least one packet;

a processor, coupled to the receiver;

6 a storage medium coupled to the processor and containing a set of  
 instructions executable by the processor to:

8                    decode each packet of the received plurality of packets comprising  
the message; and

10                  decode each incorrectly decoded packet in accordance with the  
received at least one packet; and

12                  a transmitter, coupled to the processor, configured to transmit a signal  
containing number of incorrectly decoded packets;

59.    The apparatus of claim 58 wherein the transmitter is further configured to  
2    transmit the signal containing a number of incorrectly decoded packets when  
the number of the incorrectly decoded packet is less than or equal to a code  
4    distance.

60.    The apparatus of claim 58 wherein the receiver is configured to receive  
2    the at least one other packet comprising a first set of parity bits encoded by a  
code, the code having a pre-determined code distance.

61.    The apparatus of claim 58 wherein the processor decodes each  
2    incorrectly decoded packet, by executing a set of instructions to:

                calculate for each correctly decoded packet a parity block;

4                  decode the at least one other packet to generate the first set of parity  
bits;

6                  calculate for each incorrectly decoded packet an associated parity block  
from the parity blocks of the correctly decoded packets and the first set of parity  
8    bits; and

                decode each of the incorrectly decoded packets from the associated  
10    parity blocks.

62.    The apparatus of claim 58 wherein the processor decodes each  
2    incorrectly decoded packet, by executing a set of instructions to:

                decode the at least one other packet to generate a first set of parity bits;

4                  decode a subset of incorrectly decoded packet in accordance with the  
first set of parity bits;

6                  calculate for each packet from the decoded subset an associated parity  
block; and

- 8 repeat the decoding a subset of incorrectly decoded packet in accordance with the first set of parity bits and the calculating for each packet
- 10 from the decoded subset an associated parity block until all incorrectly decoded packets are decoded.